



Product Specification

AU OPTRONICS CORPORATION

(V) Preliminary Specifications

() Final Specifications

Module	15.6" (15.55") FHD Color TFT-LCD with LED Backlight design
Model Name	B156HW01 V4 (H/W:0A)
Note ()	<i>R,G phosphor LED Backlight with driving circuit design</i>

Customer	Date	Approved by	Date
		<u>Beyond Yang</u>	<u>02/26/2009</u>
Checked & Approved by	Date	Prepared by	
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Note: This Specification is subject to change without notice.		NBBU Marketing Division / AU Optronics corporation	



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Record of Revision

Version and Date	Page	Old description	New Description	Remark
0.1 2009/02/26	All	First Edition for Customer		



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1. Handling Precautions

- 1) Since front polarizer is easily damaged, pay attention not to scratch it.
- 2) Be sure to turn off power supply when inserting or disconnecting from input connector.
- 3) Wipe off water drop immediately. Long contact with water may cause discoloration or spots.
- 4) When the panel surface is soiled, wipe it with absorbent cotton or other soft cloth.
- 5) Since the panel is made of glass, it may break or crack if dropped or bumped on hard surface.
- 6) Since CMOS LSI is used in this module, take care of static electricity and insure human earth when handling.
- 7) Do not open nor modify the Module Assembly.
- 8) Do not press the reflector sheet at the back of the module to any directions.
- 9) At the insertion or removal of the Signal Interface Connector, be sure not to rotate nor tilt the Interface Connector of the TFT Module.
- 11) After installation of the TFT Module into an enclosure (Notebook PC Bezel, for example), do not twist nor bend the TFT Module even momentarily. At designing the enclosure, it should be taken into consideration that no bending/twisting forces are applied to the TFT Module from outside. Otherwise the TFT Module may be damaged.
- 12) Small amount of materials having no flammability grade is used in the LCD module. The LCD module should be supplied by power complied with requirements of Limited Power Source (IEC60950 or UL1950), or be applied exemption.
- 13) Disconnecting power supply before handling LCD modules, it can prevent electric shock, DO NOT TOUCH the electrode parts, cables, connectors and LED circuit part of TFT module that a LED light bar build in as a light source of back light unit. It can prevent electrostatic breakdown.



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2. General Description

B156HW01 V4 is a Color Active Matrix Liquid Crystal Display composed of a TFT LCD panel, a driver circuit, and LED backlight system. The screen format is intended to support the FHD (1920(H) x 1080(V)) screen and 262k colors (RGB 6-bits data driver) with LED backlight driving circuit. All input signals are LVDS interface compatible.

B156HW01 V4 is designed for a display unit of notebook style personal computer and industrial machine.

2.1 General Specification

The following items are characteristics summary on the table at 25 °C condition:

Items	Unit	Specifications			
Screen Diagonal	[mm]	15.6W"(15.55)			
Active Area	[mm]	344.16 x 193.59			
Pixels H x V		1920x3(RGB) x 1050			
Pixel Pitch	[mm]	0.17925 x 0.17925			
Pixel Format		R.G.B. Vertical Stripe			
Display Mode		Normally White			
White Luminance (ILED=15mA) (Note: ILED is LED current)	[cd/m ²]	270 typ. (5 points average) 230 min. (5 points average)			
Luminance Uniformity		1.25 max. (5 points)			
Contrast Ratio		400 typ			
Response Time	[ms]	8 typ / 16 Max			
Nominal Input Voltage VDD	[Volt]	+3.3 typ.			
Power Consumption	[Watt]	11.5 max. (Include Logic and Blu power)			
Weight	[Grams]	475 max.			
Physical Size without inverter, bracket.	[mm]		Min.	Typ.	Max.
		Length	-	359.3-	359.8
		Width	-	209.5	210
		Thickness	-	-	5.8
Electrical Interface		2 channel LVDS			
Glass Thickness	[mm]	0.5			
Surface Treatment		Anti-glare, Hardness 2H,Haze=42%±7 Reflection type=normal, Reflection ≤ 3%			
Support Color		262K colors (RGB 6-bit)			



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Temperature Range		
Operating	[°C]	0 to +50
Storage (Non-Operating)	[°C]	-20 to +60
RoHS Compliance		RoHS Compliance

2.2 Optical Characteristics

The optical characteristics are measured under stable conditions at 25°C (Room Temperature) :

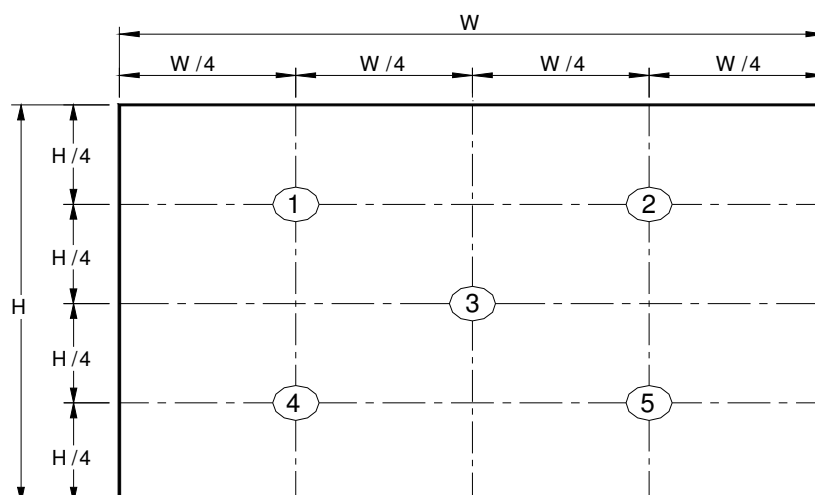
Item	Symbol	Conditions	Min.	Typ.	Max.	Unit	Note
White Luminance $I_{LED=15mA}$		5 points average	230	270	-	cd/m ²	1, 4, 5.
Viewing Angle	θ_R	Horizontal (Right)	60	70	-	Degree	4, 9
	θ_L	CR = 10 (Left)	60	70	-		
	ϕ_H	Vertical (Upper)	45	60	-		
	ϕ_L	CR = 10 (Lower)	50	60	-		
Luminance Uniformity	δ_{5P}	5 Points	-	-	1.25		1, 3, 4
Luminance Uniformity	δ_{13P}	13 Points	-	-	1.50		2, 3, 4
Contrast Ratio	CR		300	400	-		4, 6
Cross talk	%				4		4, 7
Response Time	T_r	Rising	-	TBD	-	msec	4, 8
	T_f	Falling	-	TBD	-		
	T_{RT}	Rising + Falling	-	8	16		
Color / Chromaticity Coordinates	Red	Rx	-	TBD	-	CIE 1931	4
		Ry	-	TBD	-		
	Green	Gx	-	TBD	-		
		Gy	-	TBD	-		
	Blue	Bx	-	TBD	-		
		By	-	TBD	-		
	White	Wx	0.263	0.313	0.363		
		Wy	0.279	0.329	0.379		
	NTSC	%	TBD	95	-		



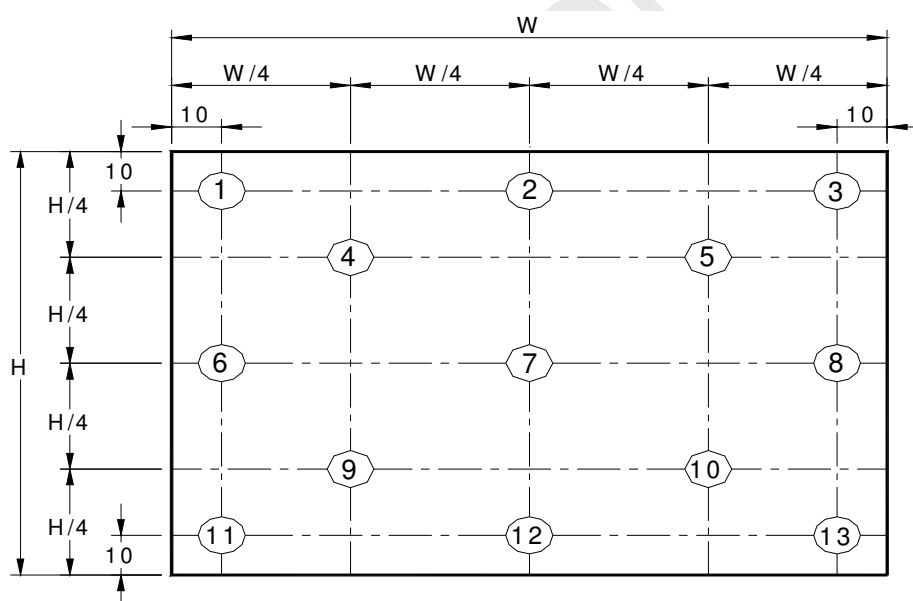
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Note 1: 5 points position (Ref: Active area)



Note 2: 13 points position (Ref: Active area)



Note 3: The luminance uniformity of 5 or 13 points is defined by dividing the maximum luminance values by the minimum test point luminance

$$\delta_{W5} = \frac{\text{Maximum Brightness of five points}}{\text{Minimum Brightness of five points}}$$

$$\delta_{W13} = \frac{\text{Maximum Brightness of thirteen points}}{\text{Minimum Brightness of thirteen points}}$$

Note 4: Measurement method

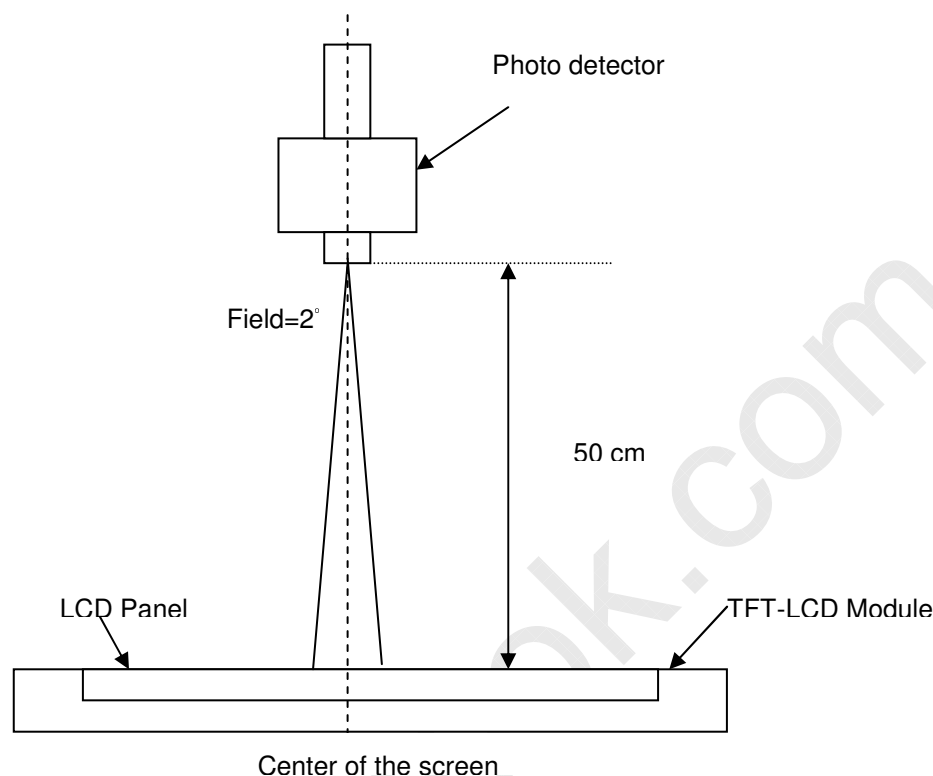
The LCD module should be stabilized at given temperature for 30 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting



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Backlight for 30 minutes in a stable, windless and dark room, and it should be measured in the center of screen.



Note 5 : Definition of Average Luminance of White (Y_L):

Measure the luminance of gray level 63 at 5 points , $Y_L = [L(1) + L(2) + L(3) + L(4) + L(5)] / 5$

$L(x)$ is corresponding to the luminance of the point X at Figure in Note (1).

Note 6 : Definition of contrast ratio:

Contrast ratio is calculated with the following formula.

$$\text{Contrast ratio (CR)} = \frac{\text{Brightness on the "White" state}}{\text{Brightness on the "Black" state}}$$

Note 7 : Definition of Cross Talk (CT)

$$CT = |Y_B - Y_A| / Y_A \times 100 (\%)$$

Where

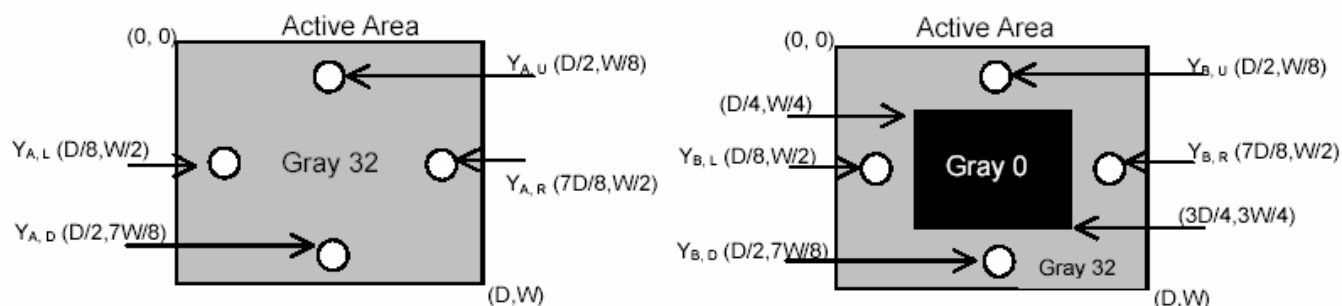
Y_A = Luminance of measured location without gray level 0 pattern (cd/m²)

Y_B = Luminance of measured location with gray level 0 pattern (cd/m²)



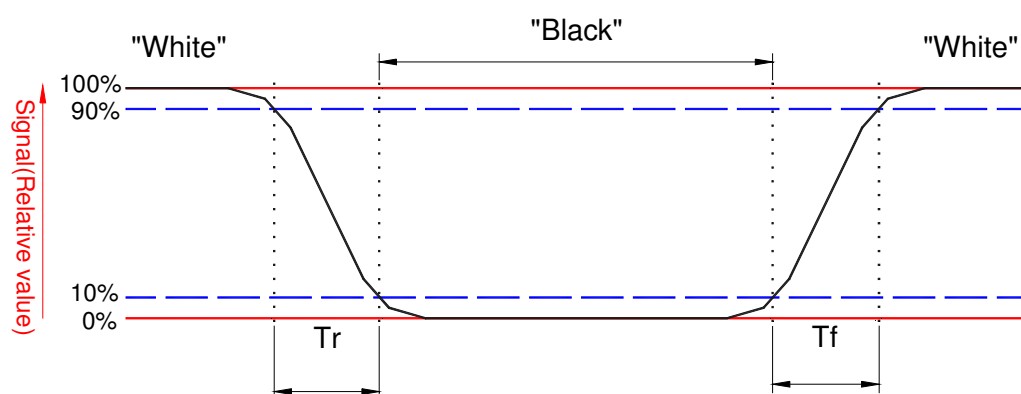
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Note 8: Definition of response time:

The output signals of BM-7 or equivalent are measured when the input signals are changed from "Black" to "White" (falling time) and from "White" to "Black" (rising time), respectively. The response time interval between the 10% and 90% of amplitudes. Refer to figure as below.



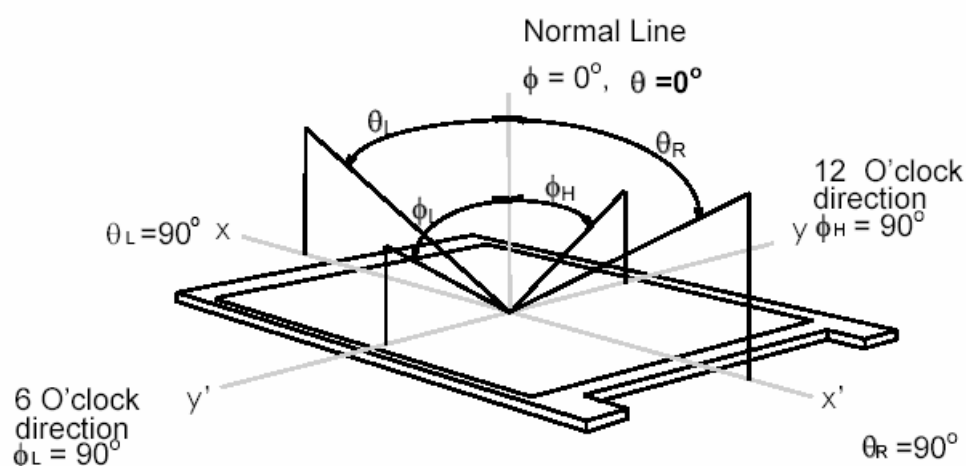


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Note 9. Definition of viewing angle

Viewing angle is the measurement of contrast ratio ≥ 10 , at the screen center, over a 180° horizontal and 180° vertical range (off-normal viewing angles). The 180° viewing angle range is broken down as follows; 90° (θ) horizontal left and right and 90° (ϕ) vertical, high (up) and low (down). The measurement direction is typically perpendicular to the display surface with the screen rotated about its center to develop the desired measurement viewing angle.



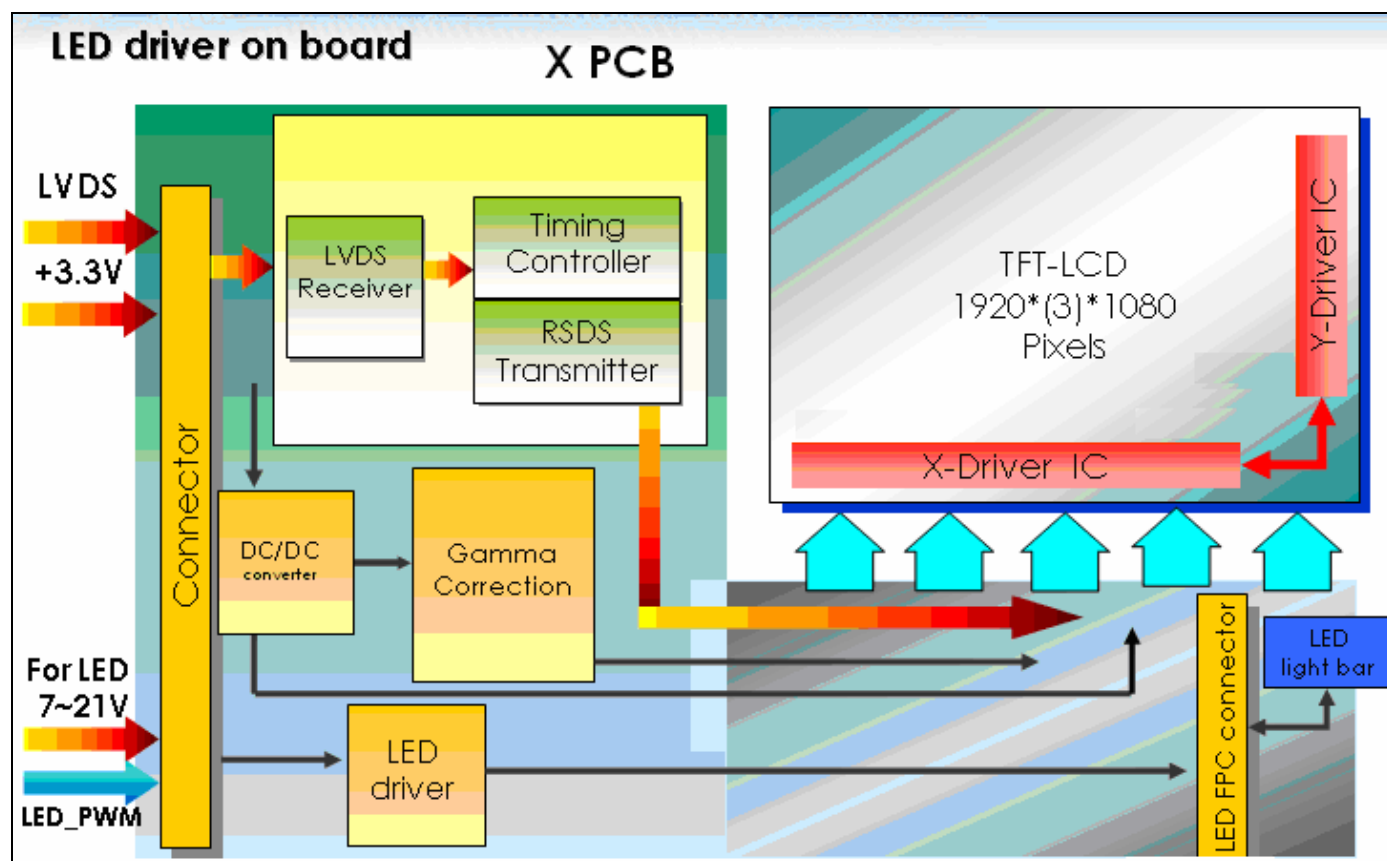


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3. Functional Block Diagram

The following diagram shows the functional block of the 15.6 inches wide Color TFT/LCD 40 Pin (Dual CH/connector Module)





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4. Absolute Maximum Ratings

An absolute maximum rating of the module is as following:

4.1 Absolute Ratings of TFT LCD Module

Item	Symbol	Min	Max	Unit	Conditions
Logic/LCD Drive Voltage	Vin	-0.3	+4.0	[Volt]	Note 1,2

4.2 Absolute Ratings of Environment

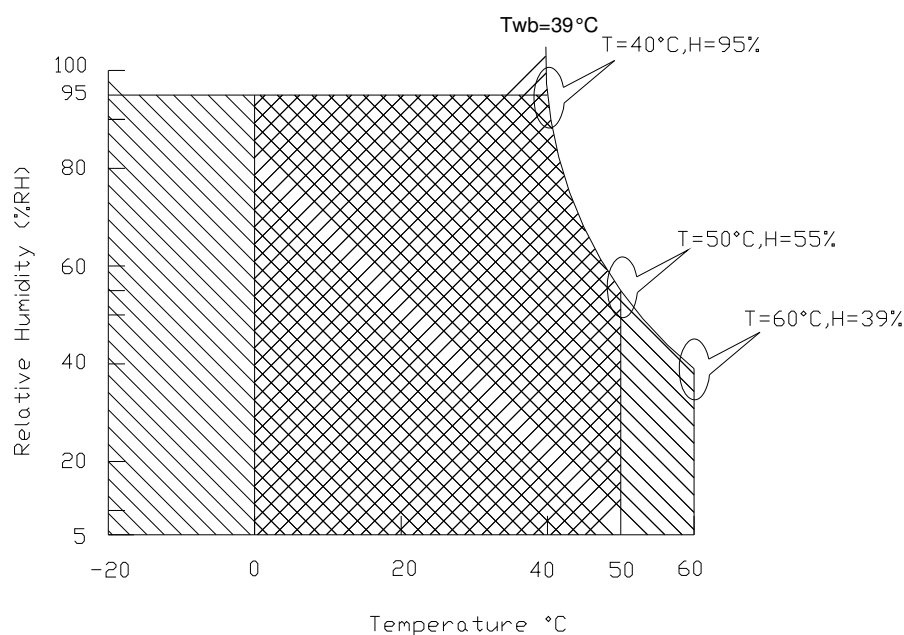
Item	Symbol	Min	Max	Unit	Conditions
Operating Temperature	TOP	0	+50	[°C]	Note 4
Operation Humidity	HOP	5	95	[%RH]	Note 4
Storage Temperature	TST	-20	+60	[°C]	Note 4
Storage Humidity	HST	5	95	[%RH]	Note 4

Note 1: At Ta (25°C)

Note 2: Permanent damage to the device may occur if exceed maximum values

Note 3: LED specification refer to section 5.2

Note 4: For quality performance, please refer to AUO IIS (Incoming Inspection Standard).



Operating Range 

Storage Range  + 



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5. Electrical characteristics

5.1 TFT LCD Module

5.1.1 Power Specification

Input power specifications are as follows;

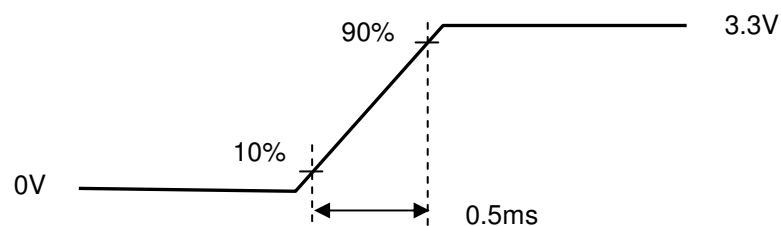
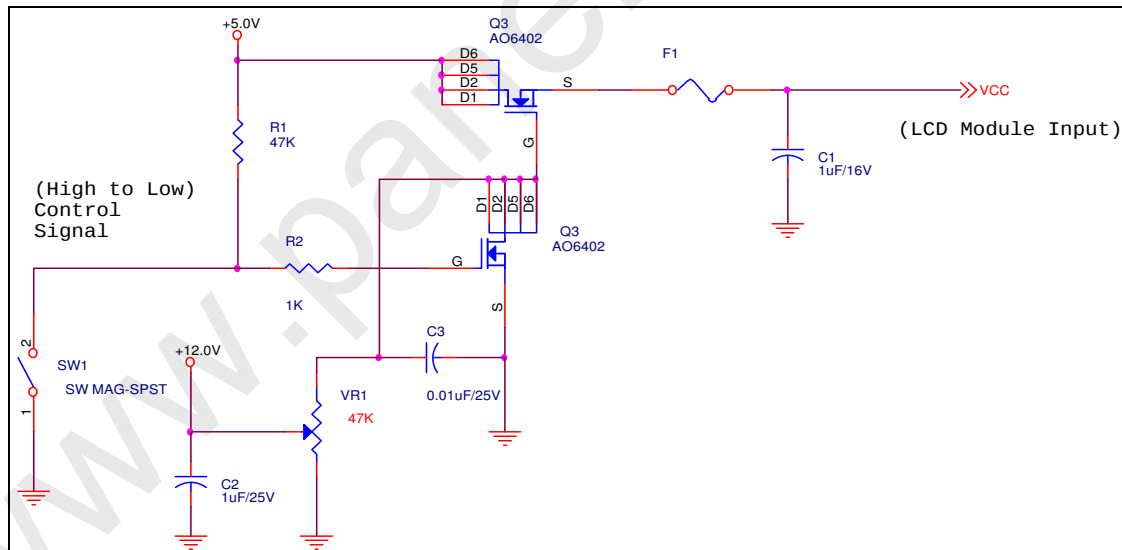
The power specification are measured under 25°C and frame frequency under 60Hz

Symble	Parameter	Min	Typ	Max	Units	Note
VDD	Logic/LCD Drive Voltage	3.0	3.3	3.6	[Volt]	
PDD	VDD Power	-	-	2.16	[Watt]	Note 1/2
IDD	IDD Current	-	-	606	[mA]	Note 1/2
IRush	Inrush Current	-	-	2000	[mA]	Note 3
VDDrp	Allowable Logic/LCD Drive Ripple Voltage	-	-	100	[mV] p-p	

Note 1 : Maximum Measurement Condition : Black Pattern

Note 2 : Typical Measurement Condition: Mosaic Pattern

Note 3 : Measure Condition



Vin rising time

5.1.2 Signal Electrical Characteristics

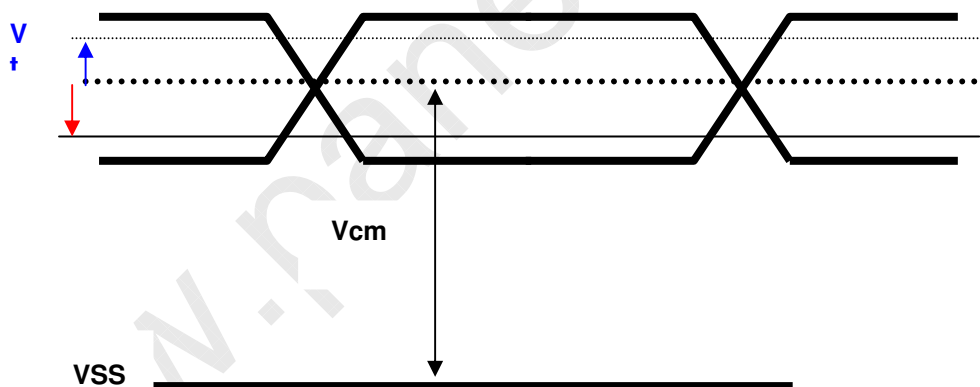
Input signals shall be low or High-impedance state when VDD is off.

It is recommended to refer the specifications of THC63LVDF84A (Thine Electronics Inc.) in detail.

Signal electrical characteristics are as follows;

Parameter	Condition	Min	Max	Unit
Vth	Differential Input High Threshold (Vcm=+1.2V)	-	100	[mV]
Vtl	Differential Input Low Threshold (Vcm=+1.2V)	-100	-	[mV]
Vcm	Differential Input Common Mode Voltage	1.0	1.4	[V]

Note: LVDS Signal Waveform





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5.2 Backlight Unit

LED Parameter guideline for LED driving selection (Ref. Remark 1)

Parameter	Symbol	Min	Typ	Max	Units	Condition
LED Forward Voltage	V_F	3.0	3.2	3.4	[Volt]	(Ta=25°C)
LED Forward Current	I_F		15		[mA]	(Ta=25°C)
LED Power consumption	P_{LED}			9.5	[Watt]	(Ta=25°C) Note 1
LED Life-Time	N/A	10,000	-	-	Hour	(Ta=25°C) $I_F=15\text{ mA}$ Note 2
Output PWM frequency	F_{PWM}	100	200	20K	Hz	
Duty ratio	--	5	--	100	%	

Note 1: Calculator value for reference $P_{LED} = V_F$ (Normal Distribution) * I_F (Normal Distribution) / Efficiency

Note 2: The LED life-time define as the estimated time to 50% degradation of initial luminous.



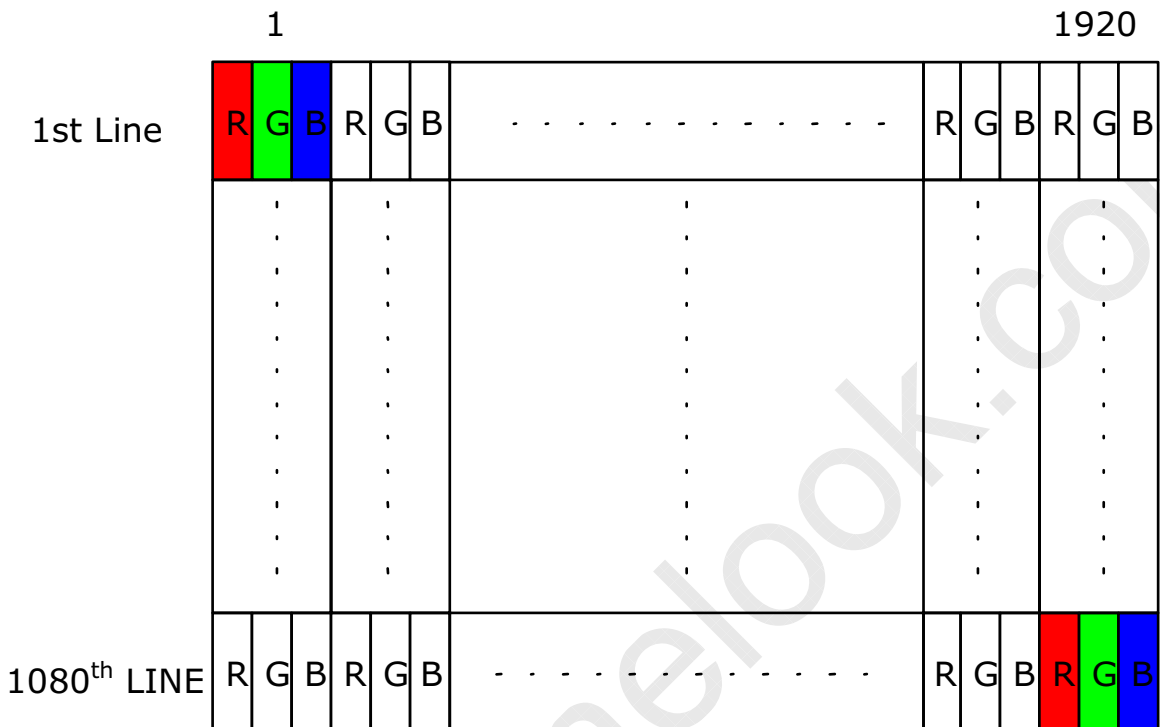
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6. Signal Characteristic

6.1 Pixel Format Image

Following figure shows the relationship of the input signals and LCD pixel format.

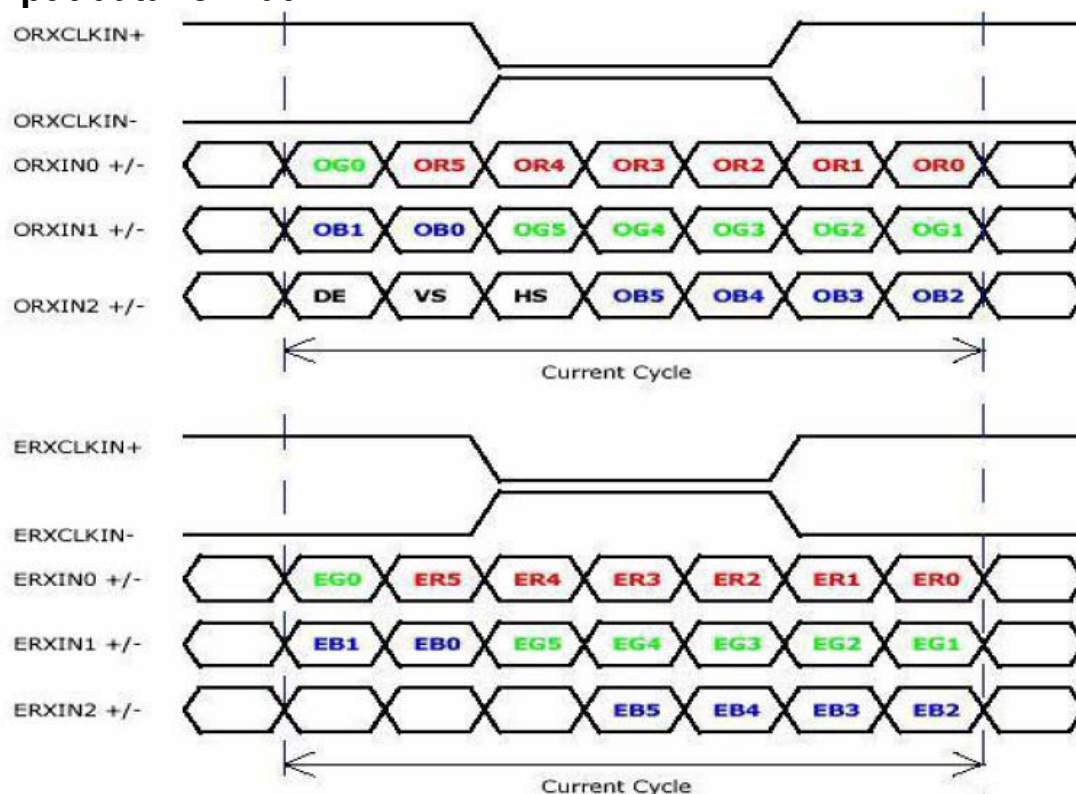




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6.2 The input data format



Signal Name	Description	
R5 R4 R3 R2 R1 R0	Red Data 5 (MSB) Red Data 4 Red Data 3 Red Data 2 Red Data 1 Red Data 0 (LSB) Red-pixel Data	Red-pixel Data Each red pixel's brightness data consists of these 6 bits pixel data.
G5 G4 G3 G2 G1 G0	Green Data 5 (MSB) Green Data 4 Green Data 3 Green Data 2 Green Data 1 Green Data 0 (LSB) Green-pixel Data	Green-pixel Data Each green pixel's brightness data consists of these 6 bits pixel data.
B5 B4 B3 B2 B1 B0	Blue Data 5 (MSB) Blue Data 4 Blue Data 3 Blue Data 2 Blue Data 1 Blue Data 0 (LSB) Blue-pixel Data	Blue-pixel Data Each blue pixel's brightness data consists of these 6 bits pixel data.
RxCLKIN	Data Clock	The signal is used to strobe the pixel data and DE signals. All pixel data shall be valid at the falling edge when the DE signal is high
DE	Display Timing	This signal is strobed at the falling edge of RxCLKIN. When the signal is high, the pixel data shall be valid to be displayed.
VS	Vertical Sync	The signal is synchronized to RxCLKIN .
HS	Horizontal Sync	The signal is synchronized to RxCLKIN .

Note: Output signals from any system shall be low or High-impedance state when VDD is off.



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6.3 Integration Interface and Pin Assignment

LVDS is a differential signal technology for LCD interface and high speed data transfer device.

Pin	Signal	Description
1	NC	No connection (Reserve)
2	VDD	PowerSupply,3.3V(typical)
3	VDD	PowerSupply,3.3V(typical)
4	VEEDID	DDC 3.3Vpower
5	NC	No connection (Reserve)
6	CIKEEDID	DDC Clock
7	DATAEEDID	DDC Data
8	Odd_Rin0-	-LVDS differential data input(R0-R5,G0)(odd pixels)
9	Odd_Rin0+	+LVDS differential data input(R0-R5,G0)(odd pixels)
10	VSS	Ground-Shield
11	Odd_Rin1-	-LVDS differential data input(G1-G5,B0-B1)(odd pixels)
12	Odd_Rin1+	+LVDS differential data input(G1-G5,B0-B1)(odd pixels)
13	VSS	Ground-Shield
14	Odd_Rin2-	-LVDS differential data input(B2-B5,HS,VS,DE)(odd pixels)
15	Odd_Rin2+	+LVDS differential data input(B2-B5,HS,VS,DE)(odd pixels)
16	VSS	Ground-Shield
17	Odd_ClkIN-	-LVDS differential clock input(odd pixels)
18	Odd_ClkIN+	+LVDS differential clock input(odd pixels)
19	VSS	Ground-Shield
20	Even_Rin0-	-LVDS differential data input(R0-R5,G0)(even pixels)
21	Even_Rin0+	+LVDS differential data input(R0-R5,G0)(even pixels)
22	VSS	Ground-Shield
23	Even_Rin1-	-LVDS differential data input(G1-G5,B0-B1)(even pixels)
24	Even_Rin1+	+LVDS differential data input(G1-G5,B0-B1)(even pixels)
25	VSS	Ground-Shield
26	Even_Rin2-	-LVDS differential data input(B2-B5,HS,VS,DE)(even pixels)
27	Even_Rin2+	+LVDS differential data input(B2-B5,HS,VS,DE)(even pixels)
28	VSS	Ground-Shield
29	Even_ClkIN-	-LVDS differential clock input(even pixels)
30	Even_ClkIN+	+LVDS differential clock input(even pixels)
31	VSSLED	LED Ground
32	VSSLED	LED Ground
33	VSSLED	LED Ground
34	NC	No connection (Reserve)
35	PWM	System PWM Signal Input
36	LED_EN	LED enable pin(+3.3V+/-0.3 Input)



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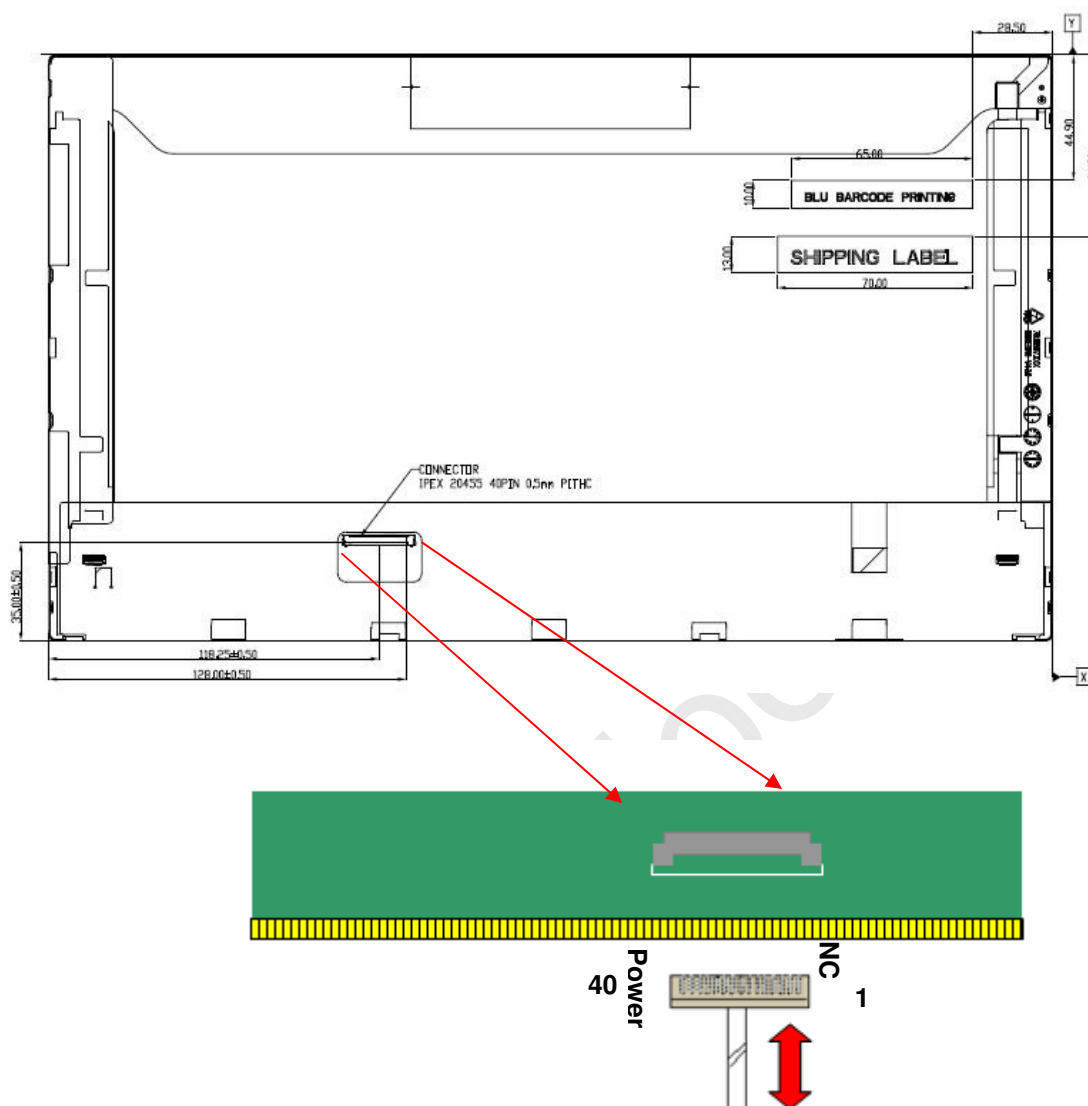
37	NC	No Connection (Reserve)
38	VLED	LED Power Supply 7V-21V
39	VLED	LED Power Supply 7V-21V
40	VLED	LED Power Supply 7V-21V



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Note1: Start from right side



Note2: Input signals shall be low or High-impedance state when VDD is off.

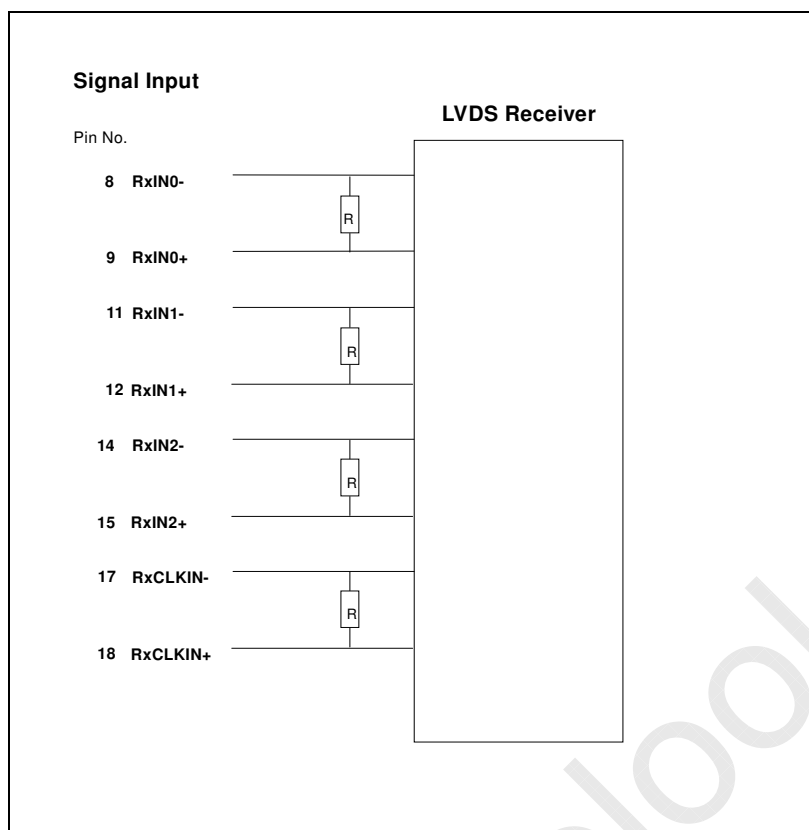


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internal circuit of LVDS inputs are as following.

The module uses a 100ohm resistor between positive and negative data lines of each receiver input





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6.4 Interface Timing

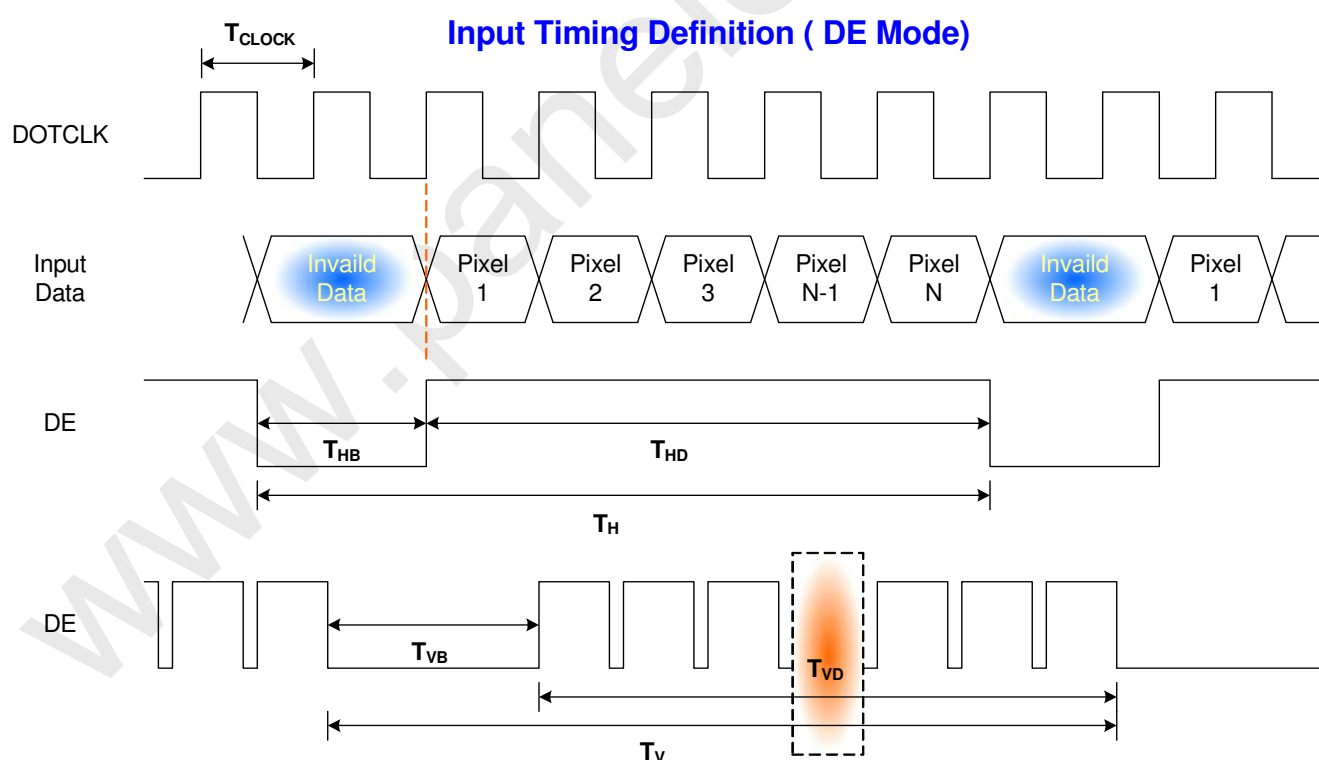
6.4.1 Timing Characteristics

Basically, interface timings should match the 1920x1080 /60Hz manufacturing guide line timing.

Parameter		Symbol	Min.	Typ.	Max.	Unit
Frame Rate		-	50	60	-	Hz
Clock frequency		1/ T _{Clock}	64.63	71.19	TBD	MHz
Vertical Section	Period	T _V	1088	1130	-	T _{Line}
	Active	T _{VD}	1080			
	Blanking	T _{VB}	8	50	-	
Horizontal Section	Period	T _H	990	1050	-	T _{Clock}
	Active	T _{HD}	960			
	Blanking	T _{HB}	30	90	-	

Note : DE mode only

6.4.2 Timing diagram



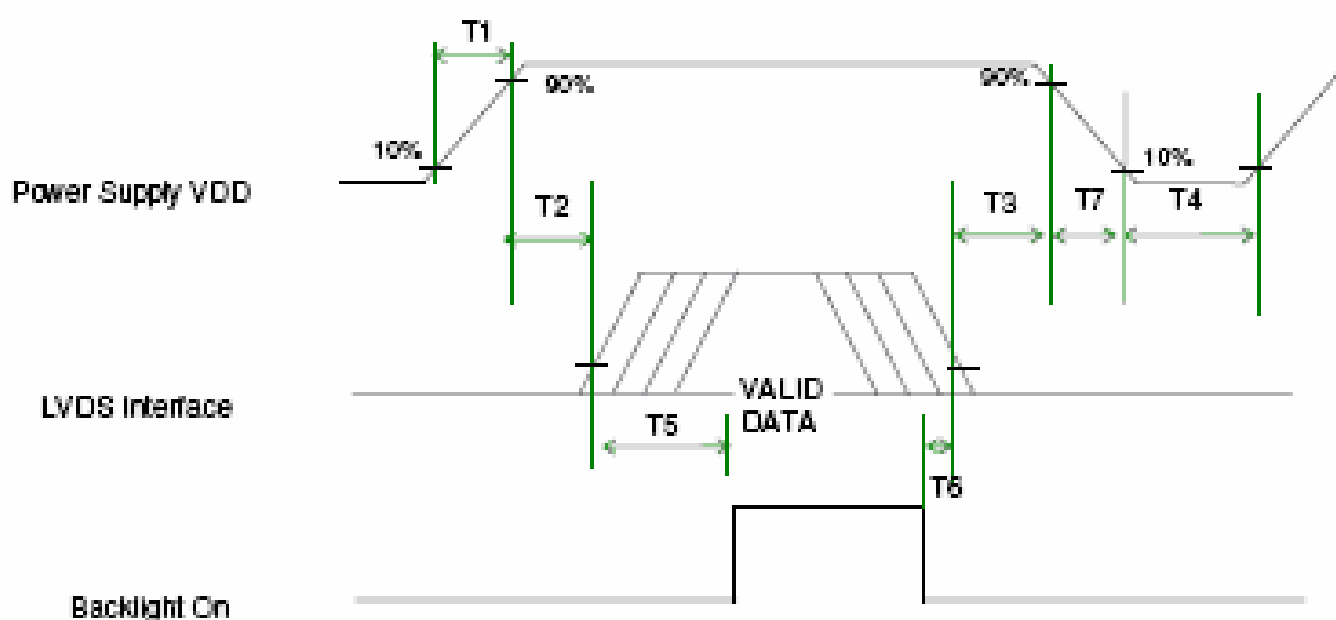


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6.5 Power ON/OFF Sequence

VDD power on/off sequence is as follows. Interface signals are also shown in the chart. Signals from any system shall be Hi-Z state or low level when VDD is off



Power Sequence Timing

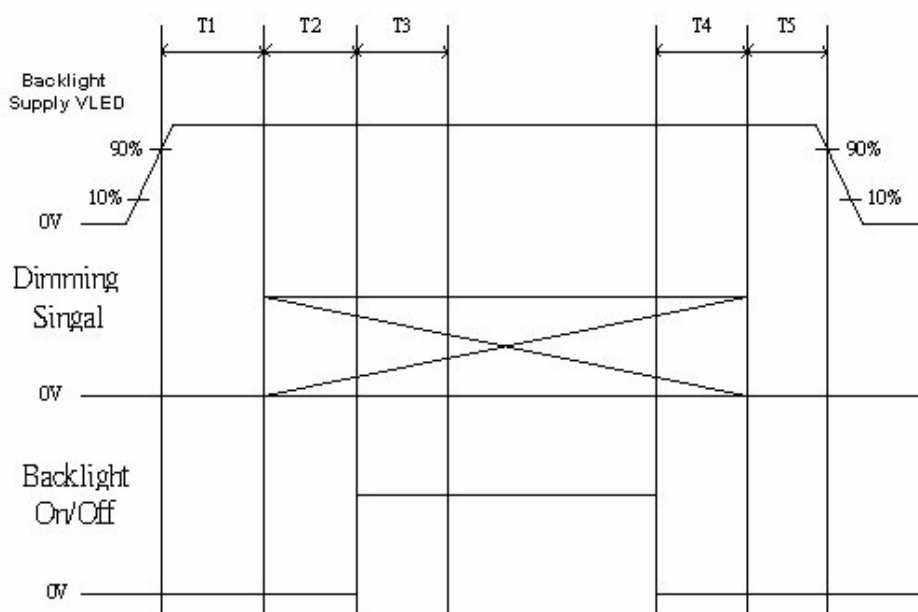
Parameter	Value			Units
	Min.	Typ.	Max.	
T1	0.5	-	10	ms
T2	0	-	50	
T3	0	-	50	
T4	400	-	-	
T5	200	-	-	
T6	200	-	-	
T7	0	-	10	



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LED on/off sequence is as follows. Interface signals are also shown in the chart.



Symbol	Values			Unit
	Min	Typ	Max	
T1	10	---	---	ms
T2	10	---	---	
T3	50	---	---	
T4	0	---	---	
T5	10	---	---	

Note: The duty of LED dimming signal should be more than 5% in T2 and T3.



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7. Connector Description

Physical interface is described as for the connector on module.

These connectors are capable of accommodating the following signals and will be following components.

7.1 TFT LCD Module

Connector Name / Designation	For Signal Connector
Manufacturer	IPEX or compatible
Type / Part Number	IPEX 20455-040E-12A or compatible
Mating Housing/Part Number	IPEX 20453-040T-11 or compatible



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8. LED Driving Specification

8.1 Connector Description

It is a integrative interface and comibe into LVDS connector. The type and mating refer to section 7.

8.2 Pin Assignment

Ref. to 6.3



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9. Vibration and Shock Test

9.1 Vibration Test

Test Spec:

- Test method: Non-Operation
- Acceleration: 1.5 G
- Frequency: 10 - 500Hz Random
- Sweep: 30 Minutes each Axis (X, Y, Z)

9.2 Shock Test Spec:

Test Spec:

- Test method: Non-Operation
- Acceleration: 220 G , Half sine wave
- Active time: 2 ms
- Pulse: X,Y,Z .one time for each side



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10. Reliability

Items	Required Condition	Note
Temperature Humidity Bias	Ta= 40°C, 90%RH, 300h	
High Temperature Operation	Ta= 50°C, Dry, 300h	
Low Temperature Operation	Ta= 0°C, 300h	
High Temperature Storage	Ta= 60°C, 35%RH, 300h	
Low Temperature Storage	Ta= -20°C, 50%RH, 250h	
Thermal Shock Test	Ta=-20°C to 60°C, Duration at 30 min, 100 cycles	
ESD	Contact : ±8 KV Air : ±15 KV	Note 1

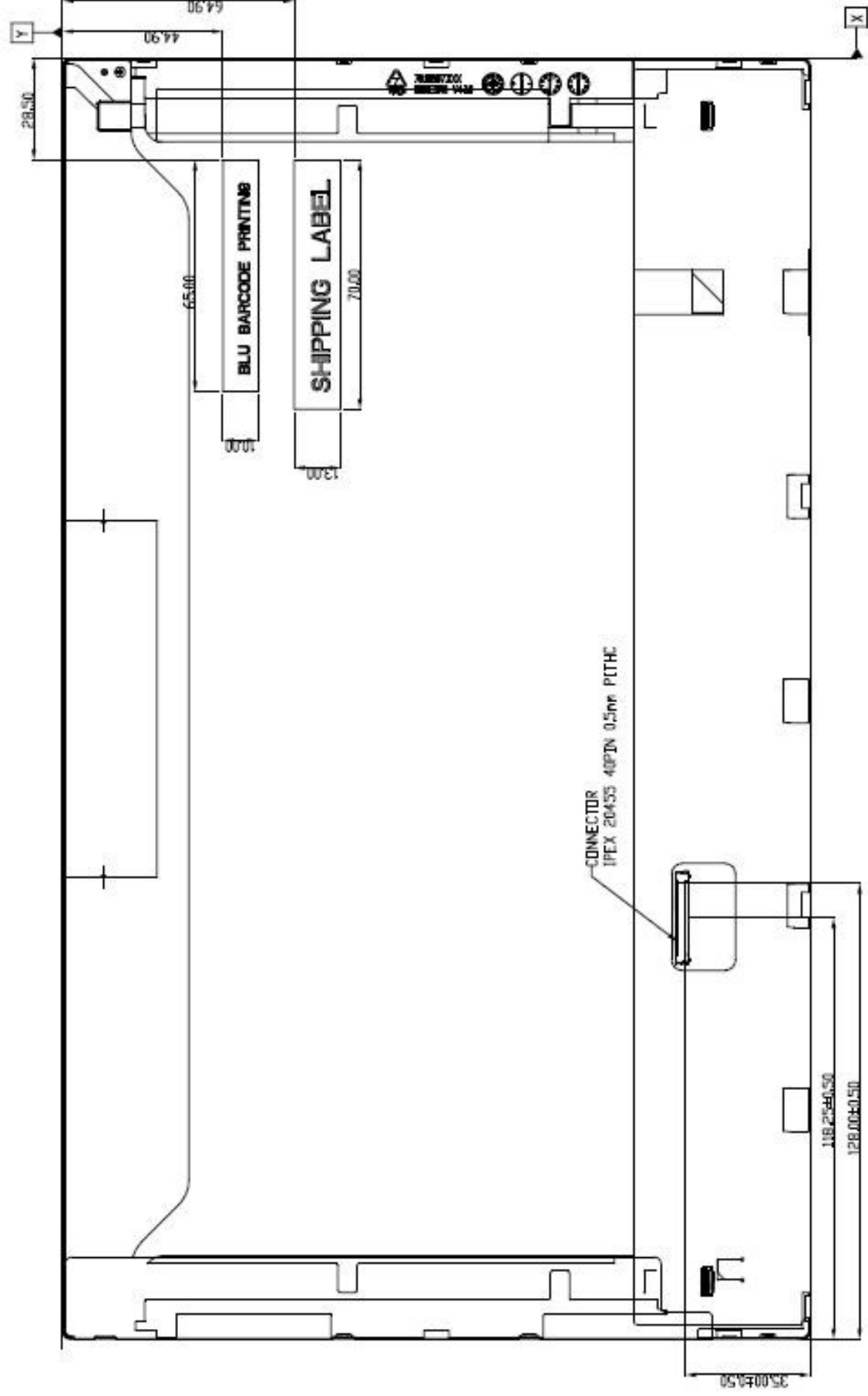
Note1: According to EN 61000-4-2 , ESD class B: Some performance degradation allowed. No data lost
Self-recoverable. No hardware failures.

Remark: MTBF (Excluding the LED): 30,000 hours with a confidence level 90%



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Note: Prevention IC damage, IC positions not allowed any overlap over these areas.



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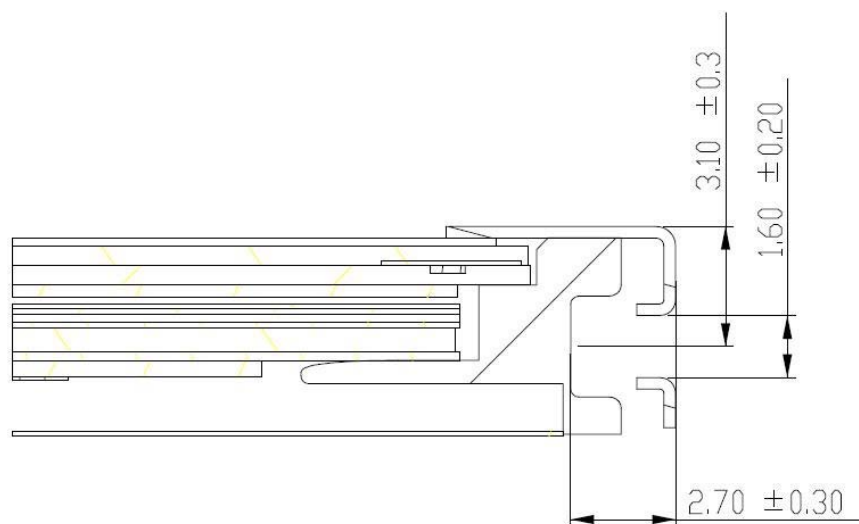
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11.2 Screw Hole Depth and Center Position

Screw hole depth, from side surface = 2.7 ± 0.3 mm (See drawing)

Screw hole center location, from front surface = 3.1 ± 0.3 mm (See drawing)

Screw Torque: Maximum 2.5 kgf-cm



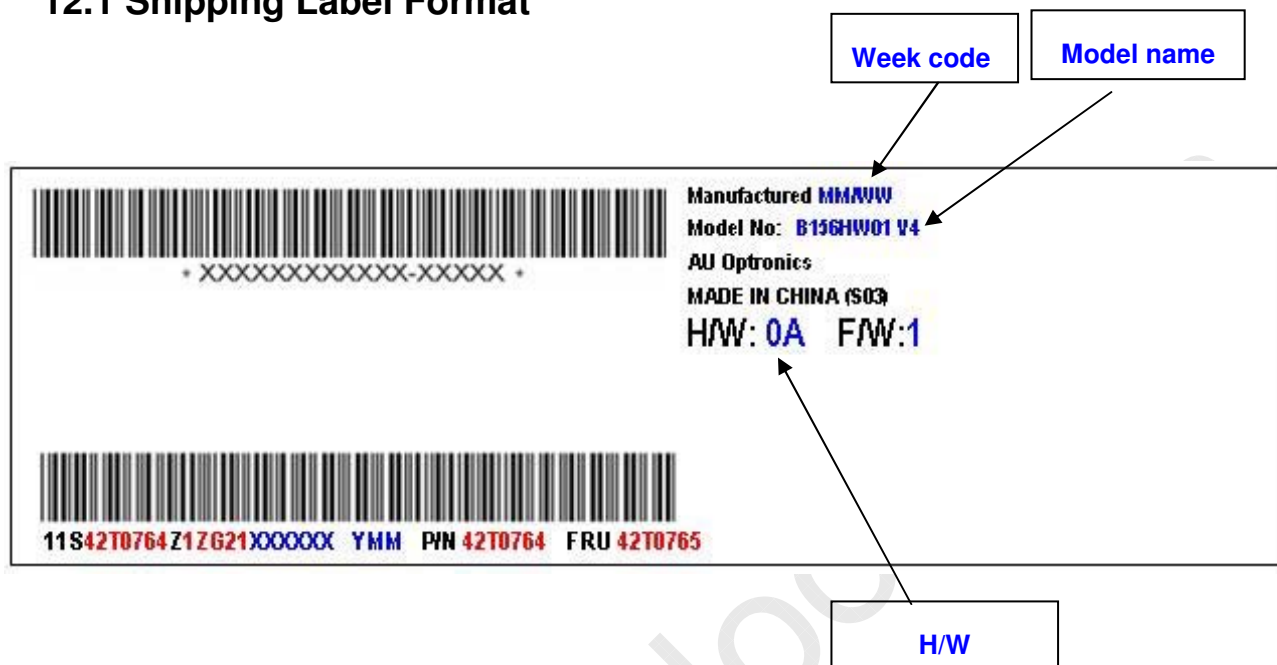


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12. Shipping and Package

12.1 Shipping Label Format



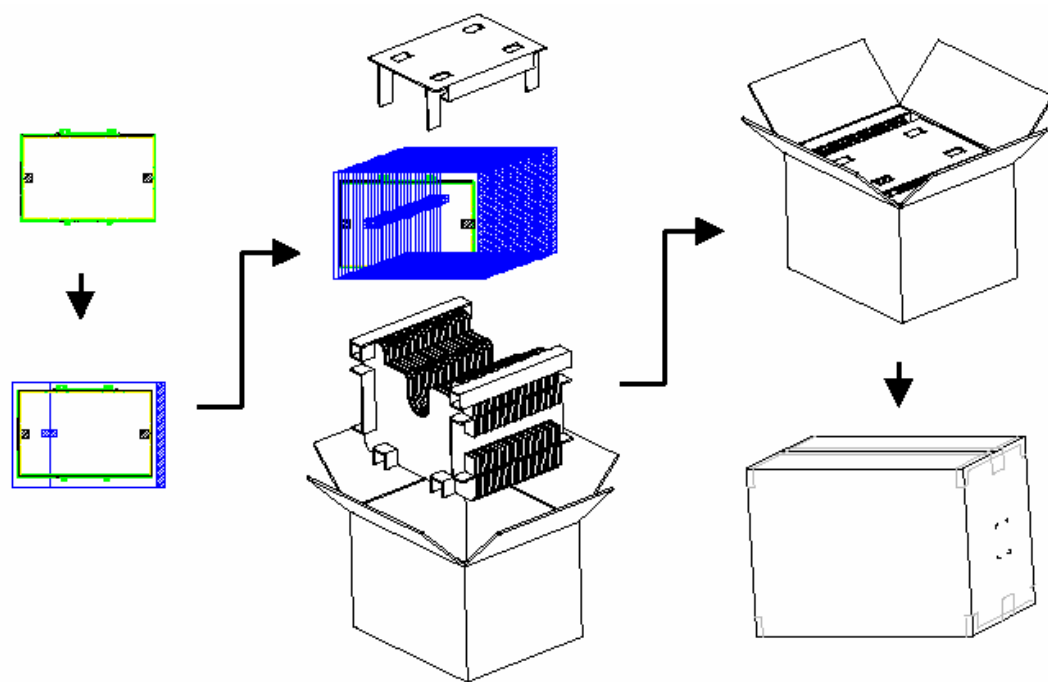


Product Specification

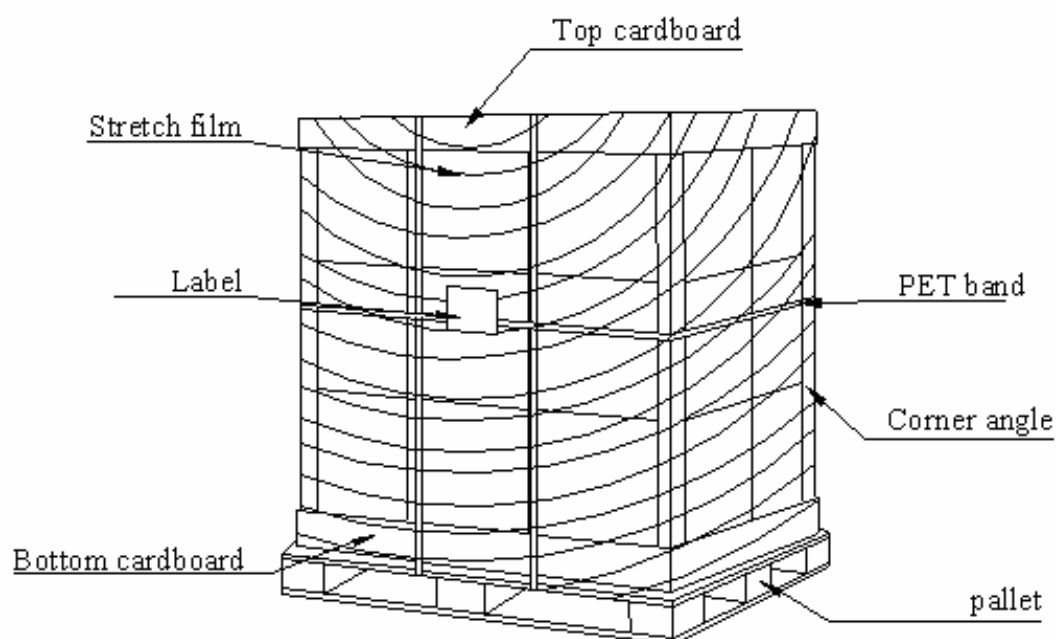
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12.2 Carton package

The outside dimension of carton is 455 (L)mm x 380 (W)mm x 355 (H)mm



12.3 Shipping package of palletizing sequence





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13. Appendix: EDID description

This cell color is fill in data for LCD Supplier. Please input two words for Hex value.							
This cell color is auto Calculation.							
This cell color is Fixed data.							
This cell color is Blank data.							
				Supplier Name			
				Supplier P/N			
				Phase			
Byte# (decimal)	Byte# (HEX)	Field Name and Comments	Value (HEX)	Remarks	Value (Hex)	Value (Decimal)	Value (Binary)
2	02	Header	FF	EDID VESA Spec Fixed	FF	255	11111111
3	03	Header	FF	EDID VESA Spec Fixed	FF	255	11111111
4	04	Header	FF	EDID VESA Spec Fixed	FF	255	11111111
5	05	Header	FF	EDID VESA Spec Fixed	FF	255	11111111
6	06	Header	FF	EDID VESA Spec Fixed	FF	255	11111111
7	07	Header	00	EDID VESA Spec Fixed	00	0	00000000
8	08	ID Manufacturer Name	30	LEN	30	48	00110000
9	09		AE		AE	174	10101110
10	0A	ID Product Code	B2		B2	178	10110010
11	0B		40	15.6"W 16:9 FHD 1920x1080 LED B/L	40	64	01000000
12	0C		00	not used	00	0	00000000
13	0D	ID Serial Number (32-bit serial number)	00	not used	00	0	00000000
14	0E		00	not used	00	0	00000000
15	0F		00	not used	00	0	00000000
16	10	Week of Manufacture			01	1	00000001
17	11	Year of Manufacture			13	19	00010011
18	12	EDID Structure version	01	Ver. 1.3	01	1	00000001
19	13	EDID Revision	03		03	3	00000011
20	14	Video Input Definition	80	Digital	80	128	10000000
21	15	Max H Image Size(mm)			22	34	00100010
22	16	Max V Image Size(mm)			13	19	00010011
23	17	Display gamma (gamma x 100)-100	78	2.2	78	120	01111000
24	18	Feature support(DPMS)	EA	Lenovo Spec fixed	EA	234	11101010
25	19	Red/Green Low Bits			21	33	00100001
26	1A	Blue/White Low Bits			3F	63	00111111
27	1B	Red x			AD	173	10101101
28	1C	Red y			50	80	01010000
29	1D	Green x			37	55	00110111
30	1E	Green y			AA	170	10101010
31	1F	Blue x			24	36	00100100
32	20	Blue y			11	17	00010001
33	21	White x			50	80	01010000
34	22	White y			55	85	01010101
35	23	Established Timing 1	00	Lenovo Spec fixed	00	0	00000000
36	24	Established Timing 2	00	Lenovo Spec fixed	00	0	00000000
37	25	Manufacturer's Timings	00		00	0	00000000
38	26	Standard Timing Identification #1	01	Lenovo Spec fixed	01	1	00000001
39	27		01	Lenovo Spec fixed	01	1	00000001
40	28	Standard Timing Identification #2	01	Lenovo Spec fixed	01	1	00000001
41	29		01	Lenovo Spec fixed	01	1	00000001
42	2A	Standard Timing Identification #3			01	1	00000001
43	2B				01	1	00000001
44	2C	Standard Timing Identification #4			01	1	00000001
45	2D				01	1	00000001
46	2E	Standard Timing Identification #5			01	1	00000001
47	2F				01	1	00000001
48	30	Standard Timing Identification #6			01	1	00000001
49	31				01	1	00000001
50	32	Standard Timing Identification #7			01	1	00000001
51	33				01	1	00000001
52	34	Standard Timing Identification #8			01	1	00000001
53	35				01	1	00000001
54	36	Pixel Clock/10,000 (LSB)		Refresh rate 60Hz	A0	160	10100000
55	37	Pixel Clock/10,000 (MSB) /			37	55	00110111
56	38	Horizontal Active			80	128	10000000
57	39	Horizontal Blanking			B4	180	10110100
58	3A	Horizontal Active : Horizontal Blanking			70	112	01110000
59	3B	Vertical Active			38	56	00111000
60	3C	Vertical Blanking			32	50	00110010
61	3D	Vertical Active : Vertical Blanking			40	64	01000000
62	3E	Horizontal Sync. Offset			6C	108	01101100
63	3F	Horizontal Sync Pulse Width			30	48	00110000
64	40	Vertical Sync Offset : Sync Width			AA	170	10101010
65	41	Horizontal/Vertical Sync Offset/Width upper 2bits			00	0	00000000
66	42	Horizontal Image Size			58	88	01011000
67	43	Vertical Image Size			C1	193	11000001
68	44	Horizontal & Vertical Image Size			10	16	00010000



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This cell color is fill in data for LCD Supplier. Please input two words for Hex value.

This cell color is auto Calculation.

This cell color is Fixed data.

This cell color is Blank data.

				Supplier Name			
				Supplier P/N			
				Phase			
				Remarks			
Byte# (decimal)	Byte# (Hex)	Field Name and Comments	Value (HEX)	Remarks	Value (Hex)	Value (Decimal)	Value (Binary)
69	46	Horizontal Border			00	0	00000000
70	46	Vertical Border			00	0	00000000
71	47	Flags			18	24	00011000
72	48	Pixel Clock/10,000 (LSB) (Slow Refresh rate)		Refresh rate 50Hz	59	89	01011001
73	49	Pixel Clock/10,000 (MSB) / (Slow Refresh rate)			2E	46	00101110
74	4A	Horizontal Active			80	128	10000000
75	4B	Horizontal Blanking			84	180	10110100
76	4C	Horizontal Active : Horizontal Blanking			70	112	01110000
77	4D	Vertical Active			38	56	00111000
78	4E	Vertical Blanking			32	50	00110010
79	4F	Vertical Active : Vertical Blanking			40	64	01000000
80	50	Horizontal Sync : Offset			6C	108	01101100
81	51	Horizontal Sync Pulse Width			30	48	00110000
82	52	Vertical Sync Offset : Sync Width			AA	170	10101010
83	53	Horizontal Vertical Sync Offset/Width upper 2bits = 0			00	0	00000000
84	54	Horizontal Image Size			58	88	01011000
85	55	Vertical Image Size			C1	193	11000001
86	56	Horizontal & Vertical Image Size			10	16	00010000
87	57	Horizontal Border			00	0	00000000
88	58	Vertical Border			00	0	00000000
89	59	Flags			18	24	00011000
90	5A	Flag	00	VESA Spec Fixed	00	0	00000000
91	5B	Flag	00	VESA Spec Fixed	00	0	00000000
92	5C	Flag	00	VESA Spec Fixed	00	0	00000000
93	5D	Data Type Tag	0F	Lenovo Spec fixed	0F	15	00001111
94	5E	Flag	00	VESA Spec Fixed	00	0	00000000
95	5F	(Horizontal active pixel /8)*31	D1	209	D1	209	11010001
96	60	Image Aspect Ratio	09	16 : 9	09	9	00001001
97	61	Middle Refresh Rate	32	50	32	50	00110010
98	62	(Horizontal active pixel /8)*31	D1	209	D1	209	11010001
99	63	Image Aspect Ratio	09	16 : 9	09	9	00001001
100	64	Low Refresh Rate	28	40	28	40	00101000
101	65	Brightness(1/10nit)	1B	270	1B	27	00011011
102	66	Feature flag	09	TN, White LED B/L	19	25	00011001
103	67	Reserved	00	Lenovo Spec fixed	00	0	00000000
104	68	LCD Supplier manufacture Code (3 character ID)			06	6	00000110
105	69				AF	175	10101111
106	6A	LCD Supplier Product code			58	86	01010110
107	6B	LCD Supplier Product code			34	52	00110100
108	6C	Flag	00	VESA Spec Fixed	00	0	00000000
109	6D	Flag	00	VESA Spec Fixed	00	0	00000000
110	6E	Flag	00	VESA Spec Fixed	00	0	00000000
111	6F	Data Type Tag	FE	Lenovo Spec fixed	FE	254	11111110
112	70	Flag	00	VESA Spec Fixed	00	0	00000000
113	71	Model Name			42	66	01000010
114	72	Model Name			31	49	00110001
115	73	Model Name			35	53	00110101
116	74	Model Name			36	54	00110110
117	75	Model Name			48	72	01001000
118	76	Model Name			57	87	01010111
119	77	Model Name			30	48	00110000
120	78	Model Name			31	49	00110001
121	79	Model Name			20	32	00100000
122	7A	Model Name			58	86	01010110
123	7B	Model Name			34	52	00110100
124	7C	Model Name			20	32	00100000
125	7D	Model Name			0A	10	00001010
126	7E	Extension flag	00	VESA Spec Fixed	00	0	00000000
127	7F	Checksum			97	151	10010111
127	7F	Checksum (Auto calc from 00h - 7Eh)			97	151	10010111
							Checksum Pass